

Remarks

Claims 20-28 and 37-42 are currently pending in the present application. New claims 43-45 are added herein, and Claim 42 is canceled without prejudice. As of the Advisory Action, Claims 20-25, 27-28, and 37-42 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Vaarstra (U.S. Patent No. 6,666,986), and Claims 20, 22, 24-26, 28, 37-38 and 40-42 stand rejected as being unpatentable under 35 U.S.C. §103(a) as being unpatentable over DeSimone et al. (U.S. Patent No. 6,763,840). Applicants will now discuss Vaarstra and DeSimone et al. in view of the new and pending claims.

Vaarstra

Vaarstra describes a supercritical etching composition for use in the etching of inorganic material from semiconductor-based substrates. In one embodiment, Vaarstra describes a composition that includes at least one supercritical component and at least one nonsupercritical etching component. The supercritical component may be selected from the group of ammonia, amines, alcohols, water, carbon dioxide, nitrous oxide, inert gases, hydrogen halides, hydrochloric acid, hydrobromic acid, boron trifluoride, chlorine, fluorine, hydrocarbons, methane, ethane, propane, fluorocarbons, hexafluoroacetylacetone, and combinations thereof. The nonsupercritical etching component may be selected from the group consisting of ammonia, hydrofluoric acid, phosphoric acid, nitric acid, acetic acid, hydrochloric acid, sulfuric acid, hydrogen peroxide, nitrous oxide, nitrogen trifluoride, sulfur hexafluoride, ozone, sulfur dioxide, sulfur trioxide, amines, ammonium salts, hexafluoroacetylacetone, and combinations thereof.

The supercritical fluid component and/or nonsupercritical component in Vaarstra may be an etchant. To this end, Vaarstra lists a wide variety of supercritical fluids, including acidic, basic, polar, and non-polar fluids. Vaarstra also lists a wide variety of commonly used etchants for the nonsupercritical component. Thus, Vaarstra provides a general listing of supercritical fluids, including carbon dioxide and ammonia, and a general listing of etchants, including hydrofluoric acid and amines. While Vaarstra allows for combinations from the general listings of components, one of skill in the art would deem some combinations as

suitable, such as the combination of two or more acids, while deeming other combinations, such as an acid and a base, as generally unsuitable. There is no teaching in Vaarstra to suggest that the combination of amines with hydrofluoric acid would be a suitable combination.

In fact, Vaarstra teaches away from such a combination. In column 6, lines 5-11, Vaarstra describes how the nonsupercritical component may vary according to the inorganic surface to be etched. Ammonia is described as being desirable for etching titanium nitride, while hydrofluoric acid is described as being desirable to remove silicon, thermally grown silicon dioxide, chemical vapor deposited silicon dioxide, or metals such as Ti metal or Al/Cu alloys. Thus, Vaarstra describes an amine as being desirable for etching one type of inorganic material, and HF as being desirable for etching another type of inorganic material.

DeSimone et al.

DeSimone et al. describes methods and an apparatus for cleaning substrates using carbon dioxide, and optionally, an adjunct. DeSimone et al. provides a large list of possible adjuncts, including water, oxidizers, acids, bases, solvents, surfactants, salts, and mixtures thereof. The general method and apparatus for cleaning substrates with carbon dioxide is the focus of DeSimone et al., and thus, the adjuncts listed are merely generally known cleaning agents. As with Vaarstra, DeSimone et al. includes combinations of adjuncts, which includes both suitable and non-suitable combinations, so that one of skill in the art may pick and choose appropriate combinations. There is no teaching in DeSimone et al. to suggest that the combination of amines with hydrofluoric acid would be a suitable combination.

Claims 20-28

Claims 20-28 recite fluid compositions comprising from 0.001 to 20 percent by weight of an adduct of hydrogen fluoride and a Lewis base, and from 50 to 99.999 percent by weight of carbon dioxide. As described in the instant specification on page 5, lines 7-19, the Lewis base is present in the composition to form an adduct with the hydrogen fluoride, which may stabilize and solubilize the hydrogen fluoride in a carbon dioxide-based etch solution.

Without the formation of this adduct, hydrogen fluoride is very difficult to stabilize or solubilize in carbon dioxide.

As discussed above, Vaarstra and DeSimone et al. only provide general lists of etchants or adjuncts, respectively. Neither discusses the desirability or the need for certain combinations of components to counteract solubility or stabilization problems. This is because neither is directed toward solving solubility or stabilization issues of components in carbon dioxide. As discussed above, there is no suggestion or motivation anywhere in either Vaarstra or DeSimone et al. to combine an acid, hydrofluoric acid, with a base, an amine, from the general listing of etchants or adjuncts, to reach the recitations of Claims 20-28. Thus, neither Vaarstra nor DeSimone et al. render Claims 20-28 obvious. Applicants respectfully request that Claims 20-28 be allowed.

Claims 37-41

Applicants submit that Claims 37-41 are also patentable for the reasons provided with respect to Claims 20-28. Additionally, Claims 37-41 are also limited to non-aqueous compositions that comprise liquid carbon dioxide. Vaarstra is only directed to the use of *supercritical fluid* compositions and does not disclose compositions comprising *liquid* carbon dioxide. As Vaarstra describes in column 4, line 66 through column 5, line 6, supercritical fluids have many unique properties that may distinguish them from liquid solvents. Toward this end, it is notable that Vaarstra does not describe the use of compressed solvents other than supercritical fluids. Further, Vaarstra is not limited to carbon dioxide and is directed toward a wide variety of supercritical fluids. Therefore, there is no suggestion or motivation to one of skill in the art to form compositions comprising liquid carbon dioxide, and thus, Vaarstra does not render Claims 37-41 obvious.

Further, DeSimone et al. does not disclose non-aqueous compositions. DeSimone et al. is not specifically directed toward etching processes, but toward general cleaning processes. Aqueous etchants may provide many difficulties, as discussed in the instant specification on page 2, lines 4-13. As DeSimone et al. is directed toward general cleaning processes, such difficulties with aqueous etching systems are not described, and so DeSimone

provides no motivation for making non-aqueous compositions. Thus, DeSimone et al. does not render the Claims 37-41 obvious.

Applicants respectfully request that Claims 37-41 be allowed.

Claims 43-49

Applicants submit that Claims 43-49 are patentable for the reasons provided above with respect to both Claims 20-28 and Claims 37-41. However, Claims 43-49 recite a particular hydrogen fluoride-Lewis base adduct, [pyridium poly(hydrogen fluoride)], which is supported by the specification on page 3, lines 22-24. This preferred adduct is neither disclosed nor suggested in either Vaarstra or DeSimone et al.

In support of the patentability of this adduct, the Examiner is referred to *In re Jones*, wherein the Court of Appeals for the Federal Circuit rejected the notion that “regardless of how broad, a disclosure of a chemical genus renders obvious any species that happen to fall within it.” 21 USPQ2d 1941, 1943 (Fed. Cir. 1992). The Court instead reiterated that “[t]he prior art must provide one of ordinary skill in the art the motivation to make the proposed molecular modifications needed to arrive at the claimed compound.” Id. at p. 1944, *citing In re Lahu*, 747 F.2d 703, 705, 223 USPQ 1257, 1258 (Fed. Cir. 1984).

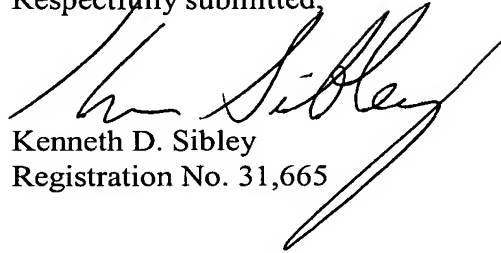
As stated above, Vaarstra and DeSimone et al. only recite general listing of etchants and adjuncts, respectively. They neither disclose nor suggest a [pyridium poly(hydrogen fluoride)] adduct. Further, as Vaarstra and DeSimone et al. are directed toward general etching and cleaning processes, and not to the stabilization of hydrofluoric acid in carbon dioxide, neither provides one of skill in the art with the motivation to make such an adduct. Thus, Vaarstra and DeSimone et al. do not render Claims 43-49 obvious.

Applicants respectfully request that Claims 43-49 be allowed.

It is respectfully submitted that this application is in condition for allowance, which action is respectfully requested.

In re: DeYoung et al.
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Respectfully submitted,

A handwritten signature in black ink, appearing to read "K. Sibley", written over the printed name and registration number.

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